Table 12-9. Evaluation of compliance with ARARs and TBCs for ARA-16, Alternative 1: No Action.

ARAR or TBC	Type	Citation	Met Evaluation[a]
Idaho Hazardous Waste Management Act	Action	IDAPA 16.01.05.006, .008, and .011, which incorporate RCRA by reference	No
Resource Conservation and Recovery Act	Action	40 CFR 262.11, Hazardous Waste Determination 40 CFR 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities 40 CFR 268, Land Disposal Restrictions	No
Toxic Substance Control Act	Action	40 CFR 761, Polychlorinated Biphenyls	No
National Emission Standards for Hazardous Air Pollutants	Action	40 CFR 61.92 and .93, national emission standards for emissions of radionuclides other than radon from DOE facilities	Yes
Idaho Ground Water Quality Rule	Chemical	IDAPA 16.01.11.200, Groundwater Quality Standards	No
Limit of 100 mrem/year effective dose equivalent to the public from exposures to external and internal radiation sources.	TBC	DOE Order 5400.5, "Radiation Protection of the Public and the Environment"	No
Limit of 10 mrem/year effective dose equivalent to the public from airborne releases.	TBC[b]	DOE Order 5400.5	No

a. A yes in the Met Evaluation column indicates that the alternative meets the ARAR or TBC.

12.2.3.1.3 Long-Term Effectiveness and Permanence—Alternative 1 does not provide long-term and permanent control of human and environmental exposure to the ARA-16 tank waste. No measures are in place to prevent release of contaminants from the site. Therefore, because potential releases of contaminants are not prevented, the long-term effectiveness and permanence of the no action alternative is considered low.

12.2.3.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment—No treatment is associated with Alternative 1. Toxicity, mobility, and volume of tank waste would remain unchanged with the exception of natural radioactive decay.

12.2.3.1.5 Short-Term Effectiveness—Alternative 1 can be implemented readily without additional risks to the community, workers, or the environment. No specialized equipment, personnel, or services are required to implement the no action alternative.

12.2.3.1.6 Cost—Estimated costs for the no action alternative, $15.7 million, are summarized in Table 11-3 and presented in detail in Appendix K. Costs for 100 years of monitoring are included.

12.2.3.1.7 Implementability—No implementation concerns are associated with the no action alternative.

12.2.3.2 Alternative 3: In Situ Vitrification Evaluation Aspects Common to Alternatives 3a, 3b1, and 3b2. The common aspects of the in situ vitrification (ISV) alternatives for the ARA-16 waste tank are evaluated in this section. Several elements of the ISV alternatives are equivalent relative to the detailed analysis evaluation criteria. These elements are addressed in this section to avoid duplication of the information presented in the evaluation of each alternative. Differences between the ISV alternatives are discussed in the respective evaluations of the individual alternatives.

12.2.3.2.1 Overall Protection of Human Health and the Environment—The ISV alternatives would provide highly effective, long-term protection of human health and the environment for the ARA-16 tank. The potential release of the tank contents would be eliminated, and direct exposure to radionuclides would be inhibited by the soil cover placed over the vitrified waste. Therefore, the ISV alternatives would meet RAOs and provide overall protection of human health and the environment.

12.2.3.2.2 Compliance with ARARs and TBCs—The evaluation of the ISV alternatives for compliance with the ARARs and TBCs is presented in Table 12-10. The RCRA and IDAPA ARARs specific to hazardous waste and TSCA ARARs specific to PCB-contaminated waste apply to the ARA-16 tank waste. Because a national TSCA operating permit exists for ISV, this alternative will meet the TSCA requirements for waste disposal; hence, the TSCA ARAR would be met. In situ vitrification will meet all RCRA treatment requirements because the organics will be destroyed and the metals immobilized. For Alternative 3a, all RCRA ARARs will be satisfied. However, the transport of the ARA-16 waste to Test Area North (TAN) (Alternatives 3b1 and 3b1) constitutes disposal of RCRA waste in a non-RCRA compliant facility; therefore, a waiver to RCRA disposal requirements would have to be obtained in to implement these alternatives. Using dust suppression techniques during construction and excavation and controlling the off-gases generated during the ISV process would ensure compliance with emissions ARARs. Surveys would be conducted at ARA-16 before any disturbance to determine the presence of any cultural resource. In the event cultural resources are discovered, activities would be modified to comply with ARARs. The DOE Order 5400.4 TBC would be met through administrative and engineering controls to ensure exposures were within allowable levels.

12.2.3.2.3 Long-Term Effectiveness and Permanence—The ISV alternatives provide long-term, permanent prevention of a release of the ARA-16 tank contents to the environment and would mitigate the potential for human and environmental exposure. The ISV technology would immobilize COCs in a glasslike matrix that would resist weathering and isolate the COCs for an estimated period of several hundred years. Exposure to direct radiation would be reduced by the addition of a soil cover for shielding. The long-term effectiveness and permanence of the soil cover is lower than that for the vitrified waste form; therefore, the long-term effectiveness and permanence for Alternative 3a is considered moderate. Because the waste would be removed from the site under Alternatives 3b1 and 3b2, the long-term effectiveness is considered high.

12.2.3.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment—In situ vitrification of tank contents would nearly eliminate the mobility of the COCs. Neither plant roots nor burrowing animals likely would penetrate the vitrified waste, and infiltration would be greatly reduced. The volume of waste likely will be reduced. The toxicity of organic COCs would be eliminated but the toxicity of the inorganic and radioactive COCs would not be reduced.

12.2.3.2.5 Short-Term Effectiveness—Any health risks to workers during ISV could be effectively mitigated using standard administrative and engineering controls. Though the ARA-16 site has been previously disturbed, archeological resources still could be found in the area. Surveys would be performed around ARA-16 before any disturbances, and activities modified to comply with ARARs if any resources are discovered. The RAOs would be achieved by these alternatives once treatment was complete.

Table 12-10. Evaluation of compliance with ARARs and TBCs for ARA-16 In Situ Vitrification Alternatives 3a, 3b1, and 3b2.

ARAR or TBC	Type	Citation	Met Evaluation[a]
Idaho Hazardous Waste Management Act	Action	IDAPA 16.01.05.006 , .008, and .011, which incorporate RCRA by reference	Yes for 3a Requires a waiver for 3b1 and 3b2
Resource Conservation and Recovery Act	Action	40 CFR 262.11, Hazardous Waste Determination 40 CFR 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities 40 CFR 268, Land Disposal Restrictions	Yes for 3a Requires a waiver for 3b1 and 3b2
Toxic Substance Control Act	Action	40 CFR 761, Polychlorinated Biphenyls	Yes
Rules for Control of Air Pollution in Idaho	Action	IDAPA 16.01.01.650-.651, Fugitive Dust	Yes
Rules for Control of Air Pollution in Idaho	Action	IDAPA 16.01.01.210, Preconstruction Compliance with Toxic Standards IDAPA 16.01.01.585-.586, Toxic Air Emissions	Yes
National Emission Standards for Hazardous Air Pollutants	Action	40 CFR 61.92 and .93, national emission standards for emissions of radionuclides other than radon from DOE facilities	Yes
Idaho Ground Water Quality Rule	Chemical	IDAPA 16.01.11.200, Groundwater Quality Standards	Yes
Rules for Control of Air Pollution in Idaho	Location	IDAPA 16.01.01.581, Prevention of Significant Deterioration	Yes
Native American Graves Protection and Repatriation Act	Location	25 USC 32	Yes
National Archeological and Historic Preservation Act	Location	36 CFR 800	Yes
Limit of 100 mrem/year effective dose equivalent to the public from exposures to external and internal radiation sources.	TBC	DOE Order 5400.5, "Radiation Protection of the Public and the Environment"	Yes
Limit of 10 mrem/year effective dose equivalent to the public from airborne releases.	TBC	DOE Order 5400.5	Yes

a. A yes in the Met Evaluation column indicates that the alternative meets the ARAR or TBC.

12.2.3.2.6 Implementability—The implementability of all ISV alternatives is considered uncertain because ISV has not been demonstrated on buried tanks containing PCB-contaminated mixed waste.

12.2.3.3 Alternative 3a: In Situ Vitrification of the ARA-16 Tank at the Existing Tank Site.

Alternative 3a consists of vitrifying the ARA-16 tank in place with the surrounding soils. A soil cover would be placed over the cooled melt for shielding.

12.2.3.3.1 Short-Term Effectiveness—The potential exposure risk to workers during vitrification of soil and tank contents at ARA-16 could be significant. However, because the soil and tank waste are not directly handled and radiation monitoring and control measures have been demonstrated to effectively mitigate risks, the short-term effectiveness of Alternative 3a is, therefore, assessed as moderate. Equipment operator and worker exposures would be minimized using established procedures. Supplied air and shielding in the form of leaded windows and lead lining on exterior facing surfaces of the equipment would be used as needed.

Construction risks to workers also are a consideration during site preparation and treatment activities. These risks result primarily from physical construction hazards such as vehicle accidents or personnel injuries. However, the implementation of appropriate health and safety measures for the excavation and treatment activities can minimize these risks.

The environmental impacts resulting from this alternative are dependent on the remedial design and required access areas. The surrounding landscape likely would be disturbed because of the equipment and vehicles moving in and around the site. However, the impact of these activities would be temporary, and the entire site would be restored to match the surrounding landscape at the completion of the project.

12.2.3.3.2 Cost—The estimated costs for Alternative 3a, $ 9.4 million, are summarized in Table 11-3 and presented in detail in Appendix K. The cost analysis includes post-closure monitoring for the duration of the 100-year period of institutional control.

12.2.3.4 Alternative 3b1: Removal and In Situ Vitrification of the ARA-16 Tank at TAN. Alternative 3b1 consists of excavating the ARA-16 tank, transporting the tank to TAN, and burying the tank in the vicinity of the V-tanks for ISV treatment. The remaining components of the ARA-16 tank system (i.e., pipes and concrete vault) would be decontaminated and disposed of at the RWMC or the proposed ICDF, and the remediated tank bed would be backfilled and revegetated. In this alternative, remediation of any contaminated soils around the tank would be addressed under the contaminated soils alternatives (see Section 12.1).

12.2.3.4.1 Short-Term Effectiveness—The exposure risk to workers during excavation and removal of the tank, and transport and burial at TAN could be significant. However, discussions with decontamination and dismantlement (D&D) personnel[b] indicate radiation monitoring and control measures that have been used in the past to transfer waste from the ARA-16 tank to the Idaho Nuclear Technology and Engineering Center (INTEC) Tank Farm will be effective in mitigating risks. Short-term effectiveness is, therefore, considered moderate. Equipment operator and worker exposures would be minimized using established procedures. Supplied air and shielding in the form of leaded windows and lead lining on exterior facing surfaces of the equipment would be used as needed.

Construction risks to workers also are a consideration during site excavation and tank removal and transportation activities. These risks result primarily from physical construction hazards such as vehicle accidents or personnel injuries. However, implementation of appropriate health and safety measures for the excavation and treatment activities can minimize these risks.

Environmental impacts resulting from Alternative 3b1 are dependent on the remedial design and required access areas. Cultural resources are known to exist within WAG 5, and surveys will be

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b. Meservey, R. H., Decontamination and Dismantlement Program, Interdepartmental personal communication with B. J. Broomfield, Lockheed Martin Idaho Technologies Company.

conducted before any disturbance. Actions will be modified as necessary to meet ARARs. The surrounding landscape likely would be disturbed because of the equipment and vehicles moving in and around the site. However, the impact of these activities would be temporary, and the entire site would be restored to match the surrounding landscape at the completion of the project.

12.2.3.4.2 Implementability—The implementability is uncertain because ISV has not yet been approved for remediation of the V-tanks and has not been demonstrated on a buried mixed waste tank. The complexity of the tank removal operation relative to safety considerations and administrative constraints has not been demonstrated. Significant effort would be required to perform environmental assessments, safety analysis, permit preparations, and equipment modifications.

12.2.3.4.3 Cost—The estimated costs for Alternative 3b1, $3.2 million, are summarized in Table 11-3 and presented in detail in Appendix K. The cost analysis incorporates the assumption that WAG 5 will pay a proportionate cost of implementing ISV of the ARA-16 tank at TAN.

12.2.3.5 Alternative 3b2: In Situ Vitrification of the ARA-16 Tank Waste at TAN. Alternative 3b2 consists of excavating the ARA-16 tank, transferring the contents of the tanks to drums or other containers, shipment to TAN, pumping the contents into one of the V-tanks, and treating the contents with the V-tanks. The ARA-16 site would be backfilled and revegetated. The tank, pipes, and concrete vault would be decontaminated and disposed of at the RWMC or the proposed ICDF. Remediation of any contaminated soils around the tank would be addressed under the contaminated soil alternatives.

12.2.3.5.1 Short-Term Effectiveness—The exposure risk to workers during excavation and removal of the tank contents, containerization of the tank waste, transport to TAN, and injection into one of the V-tanks could be significant. However, discussions with D&D[6] indicate that radiation monitoring and control measures that have been used in the past to transfer waste from the ARA-16 tank to the INTEC Tank Farm will be effective in mitigating risks. Short-term effectiveness is, therefore, considered moderate. Equipment operator and worker exposures would be minimized using established procedures. Supplied air and shielding in the form of leaded windows and lead lining on exterior facing surfaces of the equipment would be used as needed.

Construction risks to workers also are a consideration during site preparation and treatment activities. These risks result primarily from physical construction hazards such as vehicle accidents or personnel injuries. However, implementation of appropriate health and safety measures for the excavation and treatment activities can minimize these risks.

Environmental impacts resulting from this Alternative 3b1 are dependent on the remedial design and required access areas. The surrounding landscape likely would be disturbed because of the equipment and vehicles moving in and around the site. However, the impact of these activities would be temporary, and the entire site would be restored to match the surrounding landscape at the completion of the project.

12.2.3.5.2 Implementability—The implementability is uncertain because ISV has not yet been approved for the V-tanks at TAN and ISV has not been demonstrated on a buried mixed waste tank. The complexity of the tank removal operation relative to safety considerations and administrative constraints has not been demonstrated. Significant effort would be required to perform environmental assessments, safety analysis, permit preparations, and equipment modifications.

12.2.3.5.3 Cost—The estimated costs for Alternative 3b2, $ 3.8 million, are summarized in Table 11-3 and presented in detail in Appendix K. The cost analysis incorporates the assumption that costs for implementing ISV at TAN, including the ARA-16 tank waste, will be absorbed by WAG 1.

12.2.3.6 Alternative 4: Removal, Ex Situ Thermal Treatment, and Disposal. Alternative 4 consists of removing and shipping the ARA-16 tank waste for thermal treatment outside of WAG 5, disposing of the treatment residuals off-Site, excavating and removing the tank system, decontaminating or encapsulating the debris, and disposing of the debris either at a facility off the INEEL or at a disposal site on the INEEL. The tank waste would be packaged in a high-integrity container for temporary storage at the RWMC until the Advanced Mixed Waste Treatment Facility (AMWTF) becomes operational. It is assumed the ARA-16 tank system could be decontaminated and disposed of at the INEEL as low-level waste. Remediation of any contaminated soils around the tank would be addressed under the contaminated soil alternatives (see Section 12.2.1).

12.2.3.6.1 Overall Protection of Human Health and the Environment—Alternative 4 would provide highly effective, long-term protection of human health and the environment. Removal of the tank waste would eliminate potential long-term risks from exposure or contaminant migration. Therefore, Alternative 4 meets specified RAOs and provides for overall protection of human health and the environment.

12.2.3.6.2 Compliance with ARARs and TBCs—Table 12-11 presents the evaluation of Alternative 4 for compliance with ARARs and TBCs. The RCRA and IDAPA ARARs specific to hazardous waste will be met, and the TSCA ARAR specific to PCB-contaminated waste in the ARA-16 tank waste will be satisfied. Compliance with the emission control ARARs would be ensured by using dust suppression techniques during construction and excavation. Controlling the off-gases generated during the thermal treatment process will be the responsibility of the treatment vendor and is not relevant to actions conducted within WAG 5. The sites will be surveyed for cultural and archeological resources and appropriate actions taken to satisfy ARARs protection of sensitive resources. The DOE Order 5400.5 TBC would be met through administrative and engineering controls to limit exposures to allowable levels.

12.2.3.6.3 Long-Term Effectiveness and Permanence—Alternative 4 provides for long-term and permanent prevention of exposure to the ARA-16 tank contents at WAG 5. The long-term risks are basically transferred to the treatment and disposal facilities. Management practices for the facilities would ensure protection of human health and the environment. The long-term effectiveness and permanence of Alternative 4 is considered high.

12.2.3.6.4 Reduction of Toxicity, Mobility, or Volume Through Treatment—Thermal treatment would destroy the organic COCs and significantly reduce the volume of waste. The toxicity of the radionuclides and toxic metals would not be reduced, though the mobility of these contaminants in the treatment residuals from the AMWTF would be greatly reduced at the disposal location.

12.2.3.6.5 Short-Term Effectiveness—The exposure risk to workers during excavation, removal, containerization, and transport to RWMC could be significant. However, prior waste removal activities to transfer waste from ARA-16 to the INTEC Tank Farm demonstrated removal and transport of this waste could be performed safely and with minimal worker exposure.[b]. Short-term effectiveness is, therefore, considered moderate. Equipment operator and worker exposures would be minimized using established procedures. Supplied air and shielding in the form of leaded windows and lead lining on exterior facing surfaces of the equipment would be used as needed.

Construction risks to workers also are a consideration during excavation, packaging, storage, and treatment activities. These risks result primarily from physical construction hazards such as vehicle

Table 12-11. Evaluation of ARARs and TBCs for ARA-16 Alternative 4: Removal, Ex Situ Thermal Treatment, and Disposal.

ARAR or TBC	Type	Citation	Met Evaluation[a]
Idaho Hazardous Waste Management Act	Action	IDAPA 16.01.05.006, .008, and .011 which incorporate RCRA by reference	Yes
Resource Conservation and Recovery Act	Action	40 CFR 262.11—Hazardous Waste Determination 40 CFR 264—Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities 40 CFR 268—Land Disposal Restrictions	Yes
Toxic Substance Control Act	Action	40 CFR 761—Polychlorinated Biphenyls	Yes
Rules for Control of Air Pollution in Idaho	Action	IDAPA 16.01.01.650-.651—Fugitive Dust	Yes
Rules for Control of Air Pollution in Idaho	Action	IDAPA 16.01.01.210—Preconstruction Compliance with Toxic Standards IDAPA 16.01.01.585-.586—Toxic Air Emissions	Yes
National Emission Standards for Hazardous Air Pollutants	Action	40 CFR 61.92 and .93—National Emission Standards for Emissions of Radionuclides other Than Radon From Department of Energy Facilities	Yes
Rules for Control of Air Pollution in Idaho	Location	IDAPA 16.01.01.581—Prevention of Significant Deterioration	Yes
Native American Graves Protection and Repatriation Act	Location	25 USC 32	Yes
National Archeological and Historic Preservation Act	Location	36 CFR 800	Yes
Limit of 100 mrem/year effective dose equivalent to the public from exposures to external and internal radiation sources.	TBC	DOE Order 5400.5, "Radiation Protection of the Public and the Environment"	Yes
Limit of 10 mrem/year effective dose equivalent to the public from airborne releases.	TBC	DOE Order 5400.5	Yes

a. A yes in the Met Evaluation column indicates that the alternative meets the ARAR or TBC.

accidents or personnel injuries. However, implementation of appropriate health and safety measures for the excavation and treatment activities can minimize these risks.

Environmental impacts resulting from this alternative may be significant. Sensitive archeological sites may exist at ARA-16. Surveys will be conducted before any disturbance, and actions will be taken as necessary to comply with ARARs in the event that resources are discovered during the surveys.

Remedial action objectives would be achieved by this alternative upon completion of treatment.

12.2.3.6.6 Implementability—Alternative 4 is completely implementable. The RWMC facility to store the ARA-16 tank waste is operational and the capability exists to package this waste to meet acceptance criteria. Because the AMWTF has not been constructed, some uncertainty is associated with the final treatment of the ARA-16 tank waste under this option. However, other waste similar in composition to the ARA-16 tank waste currently is in storage pending the availability of treatment; therefore, appropriate treatment may reasonably be expected to become available in the future.

12.2.3.6.7 Cost—The estimated costs for Alternative 4, $4 million, are summarized in Table 11-3 and presented in detail in Appendix K.

12.3 Comparative Analysis

The comparative analysis of the remedial action alternatives is a measurement of the relative performance of alternatives against each evaluation criterion. The purpose of the comparison is to identify the relative advantages and disadvantages associated with each alternative. The comparative analysis does not identify a preferred alternative, but provides sufficient information to enable this selection by the appropriate decision makers (i.e., DOE-ID, EPA, and IDHW). The following sections present the alternative comparisons relative to each evaluation criterion for the contaminated soils sites, the ARA-02 sanitary waste system, and the ARA-16 radionuclide tank. Tables 12-12, 12-13, and 12-14 summarize how each alternative satisfies the RAOs identified in Section 9.3. Tables 12-15, 12-16, and 12-17 provide a narrative description of the relative performance of each alternative for each evaluation criterion, and Table 12-18 summarizes the comparative ranking of alternatives.

For the contaminated soil sites, the following alternatives were included in the detailed analysis and are compared in the discussions that follow:

- Alternative 1—No Action
- Alternative 3b—Excavation, Consolidation within WAG 5, and Containment using an Engineered Barrier
- Alternative 4a—Removal and Disposal at the INEEL
- Alternative 4b—Removal and Disposal off the INEEL
- Alternative 5a—Removal, Ex Situ Sorting, and Disposal on the INEEL
- Alternative 5b— Removal, Ex Situ Sorting, and Disposal off the INEEL.

The alternatives retained for detailed analysis for the ARA-02 sanitary waste system are compared in the discussions below:

- Alternative 1—No Action
- Alternative 3—Removal, Ex Situ Thermal Treatment, and Disposal

Alternative 4—In Situ Stabilization and Encapsulation.The alternatives retained for detailed analysis for the ARA-16 radionuclide tank also are compared in the discussions below:

Table 12-12. Comparison of alternatives for contaminated soils with remedial action objectives.

Criteria	Alternative 1 No action	Alternative 3b Excavation, Consolidation, and Containment using an Engineered Barrier (SL-1 type cover)	Alternative 4a Removal and Disposal on the INEEL	Alternative 4b Removal and Disposal off the INEEL	Alternative 5a Removal, Ex Situ Sorting, and Disposal on the INEEL	Alternative 5b Removal, Ex Situ Treatment, and Disposal off the INEEL
Protection of human health						
Inhibit exposure	No additional exposure prevention provided.	Exposure prevented by thick protective cover.	Eliminates potential exposure by removing contamination from site.	Eliminates potential exposure by removing contamination from site.	Eliminates potential exposure by removing contamination from site.	Eliminates potential exposure by removing contamination from site.
Protection of environment						
Inhibit exposures to ecological receptors	No additional exposure prevention provided.	Exposure prevented by thick protective cover.	Eliminates potential exposure by removing contamination from site.	Eliminates potential exposure by removing contamination from site.	Eliminates potential exposure by removing contamination from site.	Eliminates potential exposure by removing contamination from site.

Table 12-13. Comparison of alternatives for the ARA-02 sanitary waste system with remedial action objectives.

Criteria	Alternative 1 No action	Alternative 3 Removal, Ex Situ Thermal Treatment, and Disposal	Alternative 4 In Situ Stabilization and Encapsulation
Protection of human health			
Inhibit exposure	No additional exposure prevention provided.	Eliminates potential exposure by removing contamination from site.	Eliminates potential exposure by removing contamination from site.
Protection of environment			
Inhibit exposures to ecological receptors	No additional control of environmental exposure to contaminated soil.	Eliminates potential exposure by removing contamination from site.	Eliminates potential exposure by removing contamination from site.

Table 12-14. Comparison of alternatives for the ARA-16 radionuclide tank with remedial action objectives.

Criteria	Alternative 1 No action	Alternative 3a ISV of ARA-16 Tank at ARA-I	Alternative 3b Removal and ISV of ARA-16 Tank at TAN	Alternative 3b2 ISV of ARA-16 Tank Waste at TAN	Alternative 4 Removal, Ex Situ Thermal Treatment, and Disposal
Protection of human health					
Inhibit exposure	No additional exposure prevention provided.	Eliminates potential exposure by isolating and immobilizing waste.	Eliminates potential exposure by removing waste from site and immobilizing the waste at TAN.	Eliminates potential exposure by removing waste from site and immobilizing the waste at TAN.	Eliminates potential exposure by removing waste from site.
Protection of environment					
Prevent release of ARA-16 tank waste	Additional monitoring for leak detection would allow corrective action only during period of institutional control.	Prevents release by isolating and immobilizing the waste.	Prevents release by removing waste from site and immobilizing the waste at TAN.	Prevents release by removing waste from site and immobilizing the waste at TAN.	Eliminates release by removing waste from site.
Inhibit exposures to ecological receptors	No additional control of environmental exposure to contaminated soil.	Eliminates potential exposure by isolating and immobilizing waste.	Eliminates potential exposure by removing contamination from site and immobilizing the waste at TAN.	Eliminates potential exposure by removing contamination from site and isolating and immobilizing the waste at TAN.	Eliminates potential exposure by removing contamination from site.

Table 12-15. Detailed analysis summary for WAG 5 contaminated soil sites.

Criteria	Alternative 1 No action	Alternative 3b Excavation, Consolidation, and Containment using an Engineered barrier	Alternative 4a Removal and Disposal on INEEL	Alternative 4b Removal and Disposal off the INEEL	Alternative 5a Removal, Ex Situ Sorting, and Disposal on the INEEL	Alternative 5b Removal, Ex Situ Sorting, and Disposal off the INEEL
Overall protection of human health and the environment						
Human health protection	No reduction in risk.	Cap would prevent exposure to contaminated soil for 400 years.	Eliminates potential exposure to contaminated soil by removing contamination from the site.	Eliminates potential exposure to contaminated soil by removing contamination from site.	Eliminates potential exposure to contaminated soil by removing contamination from site.	Eliminates potential exposure to contaminated soil by removing contamination from site.
Environmental protection	Allows continued ecological exposures.	Cap would prevent exposure to contaminated soil for 400 years.	Eliminates potential ecological exposure to contaminated soil by removing contamination from the site.	Eliminates potential ecological exposure to contaminated soil by removing contamination from the site.	Eliminates potential ecological exposure to contaminated soil by removing contamination from the site.	Eliminates potential ecological exposure to contaminated soil by removing contamination from the site.
Compliance with ARARs						
Action-specific						
Idaho Fugitive Dust Emissions—IDAPA 16.01.01.650 et seq.	Would not meet ARAR.	Will meet ARAR by eliminating potential for windblown-soil contamination.	Will meet ARAR by eliminating potential for windblown-soil contamination.	Will meet ARAR by eliminating potential for windblown- soil contamination.	Will meet ARAR by eliminating potential for windblown soil contamination.	Will meet ARAR by eliminating potential for windblown soil contamination.
Idaho Hazardous Waste Management Act—IDAPA 16.01.05.004 et seq.	Not applicable	Would meet ARAR.	Would meet ARAR.	Would meet ARAR.	Would meet ARAR.	Would meet ARAR.
Resource Conservation and Recovery Act	Not applicable	Would meet ARAR.	Would meet ARAR.	Would meet ARAR.	Would meet ARAR.	Would meet ARAR.
Idaho Toxic Air Pollutants—IDAPA 16.01.210, .585, and .586	Not applicable	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
NESHAPS- 40 CFR 61.91 and .92	Would not meet ARAR.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
Location-specific						
Storm Water Discharges—40 CFR 122.26	Not applicable	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.

Table 12-15. (continued).

Criteria	Alternative 1 No action	Alternative 3b Excavation, Consolidation, and Containment using an Engineered barrier	Alternative 4a Removal and Disposal on INEEL	Alternative 4b Removal and Disposal off the INEEL	Alternative 5a Removal, Ex Situ Sorting, and Disposal on the INEEL	Alternative 5b Removal, Ex Situ Sorting, and Disposal off the INEEL
Native American Graves Protection and Repatriation Act—25 USC 32	Would Meet ARAR.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.
National Archeological and Historic Preservation Act—36 CFR 800	Would meet ARAR.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.
TBCs						
Radiation Protection of the Public and Environment—DOE Order 5400.5	Would not meet TBC because no controls would be implemented.	Would meet TBC through use of engineering and institutional controls and best management practices.	Would meet TBC through use of engineering and institutional controls and best management practices.	Would meet TBC through use of engineering and institutional controls and best management practices.	Would meet TBC through use of engineering and institutional controls and best management practices.	Would meet TBC through use of engineering and institutional controls and best management practices.
Long-term effectiveness and permanence						
Magnitude of residual risk	No change from existing risk.	Source-to-receptor pathways eliminated while cap remains in place.	No residual risk would remain at site.	No residual risk would remain at site.	No residual risk would remain at site.	No residual risk would remain at site.
Adequacy and reliability of controls	No control and, therefore, no reliability.	Barrier is estimated to provide control over contaminated soil for at least 400 years.	Disposal facility is assumed to provide adequate and reliable control over soil disposed of for the period of institutional controls.	Disposal facility is assumed to provide adequate and reliable control over soil disposed of for the period of institutional controls.	Disposal facility is assumed to provide adequate and reliable control over soil disposed of for the period of institutional controls.	Disposal facility is assumed to provide adequate and reliable control over disposed soil for the period of institutional controls.
Reduction of toxicity, mobility, or volume through treatment						
Treatment process used	Not applicable	Not applicable	Not applicable	Not applicable	Soil separation	Soil separation
Amount destroyed or treated	Not applicable	Not applicable	Not applicable	Not applicable	Approximately 50%	Approximately 50%
Reduction of toxicity, mobility, or volume	Not applicable	Not applicable	Not applicable	Not applicable	50% reduction in soil requiring disposal.	50% reduction of soil requiring disposal.
Irreversible treatment	Not applicable	Not applicable	Not applicable	Not applicable	Yes	Yes
Type and quantity of residuals remaining after treatment	Not applicable	Not applicable	Not applicable	Not applicable	50% of soils are above the PRGs.	50% of soils are above PRGs.

Table 12-15. (continued).

Criteria	Alternative 1 No action	Alternative 3b Excavation, Consolidation, and Containment using an Engineered barrier	Alternative 4a Removal and Disposal on INEEL	Alternative 4b Removal and Disposal off the INEEL	Alternative 5a Removal, Ex Situ Sorting, and Disposal on the INEEL	Alternative 5b Removal, Ex Situ Sorting, and Disposal off the INEEL
Statutory preference for treatment	Not applicable	Not applicable	Not applicable	Not applicable	Meets preference.	Meets preference.
Short-term effectiveness						
Community protection	No increase in potential risks to the public.	No increase in potential risks to the public.	No increase in potential risks to the public.	Slight increase in potential risks to the public during off-Site transportation.	No increase in potential risks to the public.	Slight increase in potential risks to the public during off-Site transportation.
Worker protection	Not applicable	Workers protected by administrative and engineering controls.	Workers protected by administrative and engineering controls.	Workers protected by administrative and engineering controls.	Workers protected by administrative and engineering controls.	Workers protected by administrative and engineering controls.
Environmental impacts	No change from existing conditions.	Limited to disturbances from vehicle and material transport activities associated with excavation, transportation, and barrier construction. The use of dust suppressants would limit the potential for airborne contamination in the form of fugitive dust.	Limited to disturbances from vehicle and material transport activities associated with excavation and transportation. The use of dust suppressants will limit the potential for airborne contamination in the form of fugitive dust.	Limited to disturbances from vehicle and material transport activities associated with excavation and transportation. The use of dust suppressants will limit the potential for airborne contamination in the form of fugitive dust.	Limited to disturbances from vehicle and material transport activities associated with excavation and transportation. The use of dust suppressants will limit the potential for airborne contamination in the form of fugitive dust.	Limited to disturbances from vehicle and material transport activities associated with excavation and transportation. The use of dust suppressants will limit the potential for airborne contamination in the form of fugitive dust.
Time until action is complete	Not applicable	Approximately 18 to 24 months	Approximately 18 to 24 months	Approximately 18 to 24 months	Approximately 18 to 24 months	Approximately 18 to 24 months
Implementability						
Ability to construct and operate	No construction or operation implemented.	Involves available construction technology.	Involves available excavation and transportation technology.	Involves available excavation and transportation technology.	Involves available excavation, treatment, and transportation technology.	Involves available excavation, treatment, and transportation technology.
Ease of implementing additional action if necessary	May require repeat of feasibility study and record of decision process.	Additional remedial actions would be difficult because the barrier is intended to prevent access to contamination. Barrier would require removal.	Additional remedial action would not be necessary because all contaminated soil and debris would be removed.	Additional remedial action would not be necessary, as all contaminated soil and debris are removed.	May require additional excavation and transportation of soils.	May require additional excavation and transportation of soils.

Table 12-15. (continued).

Criteria	Alternative 1 No action	Alternative 3b Excavation, Consolidation, and Containment using an Engineered barrier	Alternative 4a Removal and Disposal on INEEL	Alternative 4b Removal and Disposal off the INEEL	Alternative 5a Removal, Ex Situ Sorting, and Disposal on the INEEL	Alternative 5b Removal, Ex Situ Sorting, and Disposal off the INEEL
Ability to monitor effectiveness	Monitoring of conditions is readily implemented.	Barrier performance can be monitored through radiation surveys and can be visually assessed on the basis of physical integrity.	The effectiveness in removing all contaminated materials associated with site is easily monitored.	The effectiveness in removing all contaminated materials associated with site is easily monitored.	The effectiveness in removing all contaminated materials associated with site is easily monitored.	The effectiveness in removing all contaminated materials associated with site is easily monitored.
Ability to obtain approvals and coordinate with regulatory agencies	No approvals required.	Disposal of a landfill within WAG 5 may not be accepted by agencies.	No difficulties identified.	No difficulties identified.	No difficulties identified.	No difficulties identified.
Availability of services and capacity	None required.	Barrier design and services reside within DOE and are considered readily available to the INEEL.	Services available either on-Site or through subcontractor. Disposal capability is assumed to exist at the INEEL.	Services available either on-Site or through subcontractor.	Services available either on-Site or through subcontractor. Disposal capability is assumed to exist on the INEEL.	Services available either on-Site or through subcontractor.
Availability of equipment, specialists, and materials	None required.	Equipment and materials are readily available at the INEEL or within surrounding communities.	Equipment and materials are readily available at the INEEL or within the surrounding community.	Equipment and materials are readily available at the INEEL or within the surrounding community.	Equipment and materials are either available on-Site through subcontractors or will be purchased. Trained specialists are available within the communities surrounding the INEEL.	Equipment and materials are either available on-Site through subcontractors or will be purchased. Trained specialists are available within the communities surrounding the INEEL.
Availability of technology	None required.	Readily available at the INEEL.	Readily available at the INEEL.	Readily available at the INEEL.	Available through subcontractors.	Available through subcontractors.
Cost (present worth)						
(See Table 11-1 and Appendix K.)	$14 million	$24 million	$11 million	$24 million	$16 million	$23 million

Table 12-16. Detailed analysis summary for the ARA-02 Sanitary Waste System.

Criteria	Alternative 1 No action	Alternative 3 Removal, Ex Situ Thermal Treatment, and Disposal	Alternative 4 In Situ Stabilization and Encapsulation
Overall protection of human health and the environment			
Human health protection	No reduction in risk.	Eliminates potential exposure to waste by removing contamination from the site.	Eliminates potential exposure by stabilizing and encapsulating the waste.
Environmental protection	Allows continued ecological exposures and risk of tank waste release.	Eliminates potential ecological exposure to waste by removing contamination from the site.	Eliminates potential exposure by stabilizing and encapsulating the waste.
Compliance with ARARs			
Action-specific			
Idaho Hazardous Waste Management Act—IDAPA 16.01.05.006, .008, and .011	Would not meet ARAR.	Would meet ARAR.	Would meet ARAR.
Resource Conservation and Recovery Act	Would not meet ARAR.	Would meet ARAR.	Would meet ARAR.
Idaho Fugitive Dust Emissions—IDAPA 16.01.01.650 through .651	Not applicable	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
Rules for Control of Air Pollution in Idaho—IDAPA 16.01.01.210, and IDAPA 16.01.01.585 through .586:	Not applicable	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
NESHAPS—40 CFR 61.92 and .93	Would meet ARAR because waste is not a source of air emissions.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
Chemical-specific			
Idaho Ground Water Quality Rule—IDAPA 16.01.11.200	Would meet ARAR through monitoring.	Not applicable	Would meet ARAR through monitoring.
Location-specific			
Rules for Control of Air Pollution in Idaho—IDAPA16.01.01.581	Not applicable	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
Native American Graves Protection and Repatriation Act—25 USC 32	Would meet ARAR.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.
National Archeological and Historic Preservation Act—36 CFR 800	Would meet ARAR.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.
TBCs			
Radiation Protection of the Public and Environment—DOE Order 5400.5	Would not meet TBC because no controls would be implemented.	Would meet TBC through use of administrative controls.	Would meet TBC through use of administrative controls.
Long-term effectiveness and permanence			
Magnitude of residual risk	No change from existing risk.	No residual risk would remain at site.	Source-to-receptor pathways eliminated.

Table 12-16. (continued).

Criteria	Alternative 1 No action	Alternative 3 Removal, Ex Situ Thermal Treatment, and Disposal	Alternative 4 In Situ Stabilization and Encapsulation
Adequacy and reliability of controls	No control and, therefore, no reliability.	Disposal facilities for treated waste, contaminated soils and debris are assumed to provide adequate and reliable control for the period of institutional control.	Stabilized waste form estimated to provide reliable control over contamination in waste for at least 1000 years
Reduction of toxicity, mobility, or volume through treatment			
Treatment process used	Not applicable	Incineration	Stabilization and encapsulation
Amount destroyed or treated	Not applicable	Approximately 100%	Approximately 100%
Reduction of toxicity, mobility, or volume	Not applicable	50 to 80% volume reduction, 70% mobility reduction, and 50% toxicity reduction.	20-50% volume increase, >90% mobility reduction, 0% toxicity reduction
Irreversible treatment	Not applicable	Not reversible, but affords long-term stability.	Not reversible, but affords long-term stability
Type and quantity of residuals remaining after treatment	Not applicable	No waste would be left at the site. Incinerator ash would remain after treatment of the seepage pit sludge.	Stabilized waste form, decontamination fluids, used PPE, and air pollution control filters
Statutory preference for treatment	Not applicable	Meets preference .	Meets preference.
Short-term effectiveness			
Community protection	No increase in potential risks to the public.	Slight increase in potential risks to the public during transportation.	No increase in potential risks to the public.
Worker protection	Not applicable	Workers protected by engineering and administrative controls.	Workers protected by engineering and administrative controls.
Environmental impacts	No change from existing conditions.	Limited to disturbances from vehicle and material transport activities associated with excavation of the seepage pit. Use of containment systems with HEPA filtration and dust suppressants will significantly limit the potential for airborne contamination.	Limited to disturbances from vehicle and material transport activities associated with jet grouting of the seepage pit and grouting of the septic tanks and associated piping. Use of containment systems with HEPA filtration and dust suppressants will significantly limit the potential for airborne contamination.
Time until action is complete	Not applicable	Approximately 18 to 24 months	Approximately 12 to 15 months
Implementability			
Ability to construct and operate	No construction or operation.	Easy, involves available excavation , transportation, and treatment technology	Easy, involves available grouting and construction technology.
Ease of implementing additional action if necessary	May require repeat of feasibility study and record of decision process.	Easy. The incinerator residue could be stabilized or encapsulated using existing technology.	Moderately difficult. The stabilized waste form could be excavated, removed, and disposed of is required.
Ability to monitor effectiveness	Monitoring of conditions is readily implemented.	Sampling waste residues to verify treatment performance is easily performed.	The effectiveness in stabilizing all contaminants is easily monitored.

Table 12-16. (continued).

Criteria	Alternative 1 No action	Alternative 3 Removal, Ex Situ Thermal Treatment, and Disposal	Alternative 4 In Situ Stabilization and Encapsulation
Ability to obtain approvals and coordinate with regulatory agencies	No approvals required.	Relatively easy	Relatively easy
Availability of services and capacity	None required.	Services available on-Site.	Services available on-site and/or through subcontractor.
Availability of equipment, specialists, and materials	None required.	Equipment and materials are available either on-Site, through subcontractors, or will be purchased.	Equipment and materials are available either on-Site, through subcontractors, or will be purchased.
Availability of technology	None required.	Available at the INEEL	Available at the INEEL and commercially.
Cost (present worth)			
(See Table 11-2 and Appendix K.)	$9.3 million	$2 million	$7.5 million

Table 12-17. Detailed analysis summary for the ARA-16 Radionuclide Tank.

Criteria	Alternative 1 No action	Alternative 3a ISV of the ARA-16 Tank at ARA-1	Alternative 3b1 Removal and ISV of ARA-16 Tank at TAN	Alternative 3b2 ISV of ARA-16 Tank Waste at TAN	Alternative 4 Removal, Ex Situ Thermal Treatment, and Disposal
Overall protection of human health and the environment					
Human health protection	No reduction in risk.	Eliminates potential exposure to waste by eliminating exposure pathways.	Eliminates potential exposure to waste by removing contamination from the site.	Eliminates potential exposure to waste by removing contamination from the site.	Eliminates potential exposure to waste by removing contamination from the site.
Environmental protection	Allows continued ecological exposures and risk of tank waste release.	Eliminates potential exposure to waste by eliminating exposure pathways.	Eliminates potential ecological exposure to waste by removing contamination from the site.	Eliminates potential ecological exposure to waste by removing contamination from the site.	Eliminates potential ecological exposure to waste by removing contamination from the site.
Compliance with ARARs					
Action-specific					
Idaho Hazardous Waste Management Act—IDAPA 16.01.05.006, .008, and .011	Would not meet ARAR.	Would meet ARAR.	Would require a waiver.	Would require a waiver.	Would meet ARAR.
Resource Conservation and Recovery Act	Would not meet ARAR.	Would meet ARAR.	Would require a waiver.	Would require a waiver.	Would meet ARAR.
Toxic Substance Control Act—40 CFR 761	Would not meet ARAR.	Would meet ARAR.	Would meet ARAR.	Would meet ARAR.	Would meet ARAR.
Idaho Fugitive Dust Emissions—IDAPA 16.01.01.650 through .651	Not applicable	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
Rules for Control of Air Pollution in Idaho—IDAPA 16.01.01.210, and IDAPA 16.01.01.585 through .586:	Not applicable	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
NESHAPS—40 CFR 61.92 and .93	Would meet ARAR because waste is not a source of air emissions.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.
Chemical-specific					
Idaho Ground Water Quality Rule—IDAPA 16.01.11.200	Would meet ARAR through monitoring of ARA-16 waste tank.	Would meet ARAR by immobilizing contamination and monitoring for releases.	Would meet ARAR by immobilizing contamination and monitoring for releases.	Would meet ARAR by immobilizing contamination and monitoring for releases.	Not applicable
Location-specific					
Rules for Control of Air Pollution in Idaho—IDAPA16.01.01.581	Not applicable	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.	Would meet ARAR through use of engineering controls.

Table 12-17. (continued).

Criteria	Alternative 1 No action	Alternative 3a ISV of the ARA-16 Tank at ARA-I	Alternative 3b1 Removal and ISV of ARA-16 Tank at TAN	Alternative 3b2 ISV of ARA-16 Tank Waste at TAN	Alternative 4 Removal, Ex Situ Thermal Treatment, and Disposal
Native American Graves Protection and Repatriation Act —25 USC 32	Would meet ARAR.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.
National Archeological and Historic Preservation Act—36 CFR 800	Would meet ARAR.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.	Would meet ARAR through surveys and assessments and actions deemed necessary.
TBCs					
Radiation Protection of the Public and Environment—DOE Order 5400.5	Would not meet TBC because no controls would be implemented.	Would meet TBC through use of engineering and institutional controls and best management practices.	Would meet TBC through use of engineering and institutional controls and best management practices.	Would meet TBC through use of engineering and institutional controls and best management practices.	Would meet TBC through use of administrative controls.
Long-term effectiveness and permanence					
Magnitude of residual risk	No change from existing risk.	Source-to receptor pathways eliminated.	No residual risk would remain at sites.	No residual risk would remain at sites.	No residual risk would remain at sites.
Adequacy and reliability of controls	No control and, therefore, no reliability.	Vitrified waste form estimated to provide reliable control over contaminants in waste for hundreds of years.	Vitrification at TAN is estimated to provide reliable control over contaminants in waste for hundreds of years. Disposal facility for contaminated soils and debris is assumed to provide adequate and reliable control for the period of institutional control.	Vitrification at TAN is estimated to provide reliable control over contaminants in waste for hundreds of years. Disposal facility for contaminated soils and debris is assumed to provide adequate and reliable control for the period of institutional control.	Disposal facility for treated waste, contaminated soils, and debris is assumed to provide adequate and reliable control for the period of institutional control.
Reduction of toxicity, mobility, or volume through treatment					
Treatment process used	Not applicable	ISV	ISV	ISV	Incineration
Amount destroyed or treated	Not applicable	Approximately 100%	Approximately 100%	Approximately 100%	Approximately 100%
Reduction of toxicity, mobility, or volume	Not applicable	40 to 50% volume reduction, 100% mobility reduction, and 50% toxicity reduction.	40 to 50% volume reduction, 100% mobility reduction, and 50% toxicity reduction.	40 to 50% volume reduction, 100% mobility reduction, and 50% toxicity reduction.	50 to 80% volume reduction, 70% mobility reduction, and 50% toxicity reduction.
Irreversible treatment	Not applicable	Not reversible, but affords long-term stability.	Not reversible, but affords long-term stability.	Not reversible, but affords long-term stability.	Not reversible, but affords long-term stability.
Type and quantity of residuals remaining after treatment	Not applicable	Vitrified waste form, decontamination fluids, used PPE.	No waste would be left at the site. Vitrified waste form, decontamination fluids, and used PPE would be left at the site of treatment.	No waste would be left at the site. Vitrified waste form, decontamination fluids, and used PPE would be left at the site of treatment.	No waste would be left at the site. A vitrified mass, decontamination fluids and used PPE would remain after treatment of the tank waste.
Statutory preference for treatment	Not applicable	Meets preference.	Meets preference.	Meets preference.	Meets preference.

Table 12-17. (continued).

Criteria	Alternative 1 No action	Alternative 3a ISV of the ARA-16 Tank at ARA-I	Alternative 3b1 Removal and ISV of ARA-16 Tank at TAN	Alternative 3b2 ISV of ARA-16 Tank Waste at TAN	Alternative 4 Removal, Ex Situ Thermal Treatment, and Disposal
Short-term effectiveness					
Community protection	No increase in potential risks to the public.	No increase in potential risks to the public.	No increase in potential risks to the public.	No increase in potential risks to the public.	Slight increase in potential risks to the public during off-Site transportation.
Worker protection	Not applicable	Workers protected by engineering and administrative controls.	Workers protected by engineering and administrative controls.	Workers protected by engineering and administrative controls.	Workers protected by engineering and administrative controls.
Environmental impacts	No change from existing conditions.	Limited to site preparation required for ISV. Limited potential for airborne contamination.	Limited to disturbances from vehicle and material transport activities associated with excavation of the tank system. Use of dust suppressants will significantly limit the potential for airborne contamination in the form of fugitive dust.	Limited to disturbances from vehicle and material transport activities associated with removal of the waste from the tank and excavation of the tank system. Use of containment systems with HEPA filtration and dust suppressants will significantly limit the potential for airborne contamination.	Limited to disturbances from vehicle and material transport activities associated with excavation of the tank. Use of containment systems with HEPA filtration and dust suppressants will significantly limit the potential for airborne contamination.
Time until action is complete	Not applicable	Approximately 18 to 24 months	Approximately 18 to 24 months	Approximately 18 to 24 months	Approximately 18 to 24 months
Implementability					
Ability to construct and operate	No construction or operation.	Moderately difficult; involves proprietary technology.	Moderately difficult; involves proprietary technology as well as available construction technology.	Moderately difficult; involves proprietary technology as well as available construction technology.	Moderate because of radiation protection requirements. Uses available construction technology.
Ease of implementing additional action if necessary	May require repeat of feasibility study and record of decision process.	Moderately difficult. The relatively small vitrified waste form could be excavated, removed, and disposed of if required.	Very difficult. The relatively large vitrified waste form that would be generated at the V-tank site could be excavated, removed, and disposed of with great difficulty, if required.	Very difficult. The relatively large vitrified waste form that would be generated at the V-tank site could be excavated, removed, and disposed of with great difficulty. if required.	Easy. Residues from the tank waste could be stabilized.
Ability to monitor effectiveness	Monitoring of conditions is readily implemented.	The effectiveness in vitrifying all contaminants is easily monitored.	The effectiveness in vitrifying all contaminants is easily monitored.	The effectiveness in vitrifying all contaminants is easily monitored.	Sampling of waste residues to verify treatment performance is easily performed.
Ability to obtain approvals and coordinate with regulatory agencies	No approvals required.	Difficult because of the presence of RCRA- and TSCA-regulated components in the waste. ARAR waivers would be required.	Difficult because of the presence of RCRA- and TSCA-regulated components in the waste. ARAR waivers would be required.	Difficult because of the presence of RCRA- and TSCA-regulated components in the waste. ARAR waivers would be required.	Relatively easy

Table 12-17. (continued).

Criteria	Alternative 1 No action	Alternative 3a ISV of the ARA-16 Tank at ARA-I	Alternative 3b1 Removal and ISV of ARA-16 Tank at TAN	Alternative 3b2 ISV of ARA-16 Tank Waste at TAN	Alternative 4 Removal, Ex Situ Thermal Treatment, and Disposal
Availability of services and capacity	None required.	Services for ISV at ARA-16 are available through a subcontractor.	On-site support is available to remove and transfer the tank waste to TAN. The ISV services are available through a subcontractor.	On-Site support is available to remove and transfer the tank waste to TAN. The ISV services are available through a subcontractor.	Services available on-Site.
Availability of equipment, specialists, and materials	None required.	Equipment and materials to perform ISV at ARA-16 are available through a subcontractor.	Equipment and materials for tank removal and transport to TAN are available on-Site. Equipment to perform ISV is available from a subcontractor.	Equipment and materials for tank waste removal and transport to TAN are available on-Site. Equipment to perform ISV is available from a subcontractor.	Equipment and materials are available either on-Site, through subcontractors, or will be purchased.
Availability of technology	None required.	Available commercially.	Available commercially.	Available commercially.	Available at the INEEL.
Cost (present worth)					
(See Table 11-3 and Appendix K.)	$ 9.3 million	$ 8.6 million	$ 3.8 million	$ 4.6 million	$ 4.4 million

Table 12-18. Comparative ranking of remedial alternatives relative to the CERCLA evaluation criteria.

Evaluation criteria	Ranked Alternatives for Contaminated Soil Sites[a]	Ranked Alternatives for the ARA-02 Sanitary Waste System[b]	Ranked Alternatives for the ARA-16 Radionuclide Tank[c]
Overall protection of human health and the environment	(4a, 4b, 5a, 5b), 3b, 1	3, 4, 1	4, (3b1, 3b2), 3a, 1
Compliance with ARARs	(3b, 4a, 4b, 5a, 5b), 1	(3, 4), 1	4, 3a, (3b1, 3b2), 1
Long-term effectiveness and permanence	(4a, 4b, 5a, 5b) 3b, 1	3, 4, 1	(4, 3b1, 3b2), 3a, 1
Reduction of toxicity, mobility or volume through treatment	(5a, 5b), (4a, 4b, 3b, 1)	3, 4, 1	(4, 3a, 3b1, 3b2), 1
Short-term effectiveness	1, (3b, 4a), 4b, 5a, 5b	4,3, 1	1,3a, 3b1, (3b2, 4)
Implementability	1, (3b, 4a, 4b), (5a, 5b)	1, (3, 4)	1, 4, 3a, (3b1, 3b2)
Cost	4a, 1, 5a, 5b, (3b, 4b)	3, 4, 1	3b1, (3b2, 4), 3a, 1

a. Alternatives for contaminated soil sites:

Alternative 1—No Action
Alternative 3b—Excavation, Consolidation within WAG 5, and Containment using an Engineered Barrier
Alternative 4a—Removal and Disposal on the INEEL
Alternative 4b—Removal and Disposal off the INEEL
Alternative 5a—Removal, Ex Situ Sorting, and Disposal on the INEEL
Alternative 5b—Removal, Ex Situ Sorting, and Disposal off the INEEL.

b. Alternatives for the ARA-02 seepage pit sludge:

Alternative 1—No Action
Alternative 3—Removal, Ex Situ Thermal Treatment, and Disposal
Alternative 4—In Situ Stabilization and Encapsulation.

c. Alternatives for the ARA-16 tank system and contents:

Alternative 1—No Action
Alternative 3a—ISV at the ARA-16 Tank Site at ARA-1
Alternative 3b1—Removal and ISV of the ARA-16 Tank at TAN
Alternative 3b2—Removal and ISV of the ARA-16 Tank Contents at TAN
Alternative 4—Removal, Ex Situ Thermal Treatment, and Disposal.

- Alternative 1—No Action
- Alternative 3a—ISV at the ARA-16 Tank Site at ARA-I
- Alternative 3b1—Removal and ISV of the ARA-16 Tank at TAN
- Alternative 3b2—Removal and ISV of the ARA-16 Tank Contents at TAN
- Alternative 4—Removal, Ex Situ Thermal Treatment, and Disposal.

12.3.1 Overall Protection of Human Health and the Environment

The primary measure of this criterion is the ability of an alternative to achieve RAOs for WAG 5 sites. Alternative 1, no action, would not prevent exposures resulting in risks greater than 1E-04 or HIs greater than 1.0 for the soils sites, ARA-02, or ARA-16.

For the contaminated soil sites, Alternatives 4a, 4b, 5a, and 5b (excavation and disposal on-Site or off-Site; and excavation, separation, and disposal on-Site or off-Site) would provide the most effective long-term protection of human health and the environment because all contamination above risk-based levels would be removed from WAG 5. The four alternatives, relative to human health protection, are equivalent (i.e., separation would not improve the effectiveness of the remedy). The containment option (Alternative 3b: engineered barrier) would meet human health and ecological risk RAOs, but is regarded as somewhat less effective than 4a, 4b, 5a, or 5b because of uncertainties that the engineered barrier would provide sufficient protection from the longer lived radionuclide Ag-108m and because contaminated media would remain within WAG 5.

For the ARA-02 sanitary waste system, Alternative 3 (excavation, ex situ thermal treatment, and disposal) would provide the most effective long-term protection of human health and the environment because the contaminated media would be removed from WAG 5. Alternative 4 (in situ stabilization and encapsulation) would be somewhat less protective within WAG 5 because the stabilized waste would remain at ARA-I.

For the ARA-16 radionuclide tank, Alternative 4 (excavation, ex situ thermal treatment, and disposal) would provide the most effective long-term protection of human health and the environment because the contaminated media would be removed from WAG 5, treated, and disposed in an approved facility. Alternatives 3b1 and 3b2 would be equivalent at protecting human health and the environment, because the waste would be removed from WAG 5 and treated to isolate the contaminants in a vitrified waste form estimated to maintain integrity for geologic time periods. Alternative 3a would be somewhat less protective within WAG 5 because the vitrified tank site would remain at ARA-I and the long-term effectiveness of the soil cover is less than the vitrified waste form.

12.3.2 Compliance with ARARs

Comparison of compliance with ARARs is summarized in Table 12-15 for contaminated soils sites, Table 12-16 for ARA-02, and Table 12-17 for ARA-16. The comparative ranking of alternatives relative to compliance with ARARs is shown in Table 12-18. The ARARs for Alternative 1 (no action) would not be met for the contaminated soil sites, ARA-02, or ARA-16. Alternatives 3b, 4a, 4b, 5a, and 5b for the contaminated soil sites would all meet ARARs and are ranked equally. Alternatives 3 and 4 would both meet all ARARs for ARA-02. Alternatives 4 and 3a for the ARA-16 tank would meet ARARs but Alternatives 3b1 and 3b2 would not meet ARARs unless ARAR waivers were obtained.

12.3.3 Long-Term Effectiveness and Permanence

Alternative 1 (no action) would provide the least long-term effectiveness and permanence for the contaminated soil sites, ARA-02, and ARA-16. Alternatives 4a, 4b, 5a, and 5b for the contaminated soil sites (conventional excavation and disposal; and conventional excavation, separation, and disposal) would provide the highest degree of long-term effectiveness and permanence because contaminated soil and debris would no longer exist at the sites. Engineering or administrative controls at the individual sites would not be required if all soil contaminated above PRGs were removed. Alternative 3b (the engineered barrier) would be less effective and permanent and also would require monitoring, maintenance, and 5-year reviews during the institutional control period.

For the ARA-02 sanitary waste system, Alternative 3 (excavation, ex situ thermal treatment, and disposal) would provide the highest degree of long-term effectiveness and permanence because the waste would be removed from the site.

For the ARA-16 radionuclide tank, Alternative 4 (excavation, ex situ thermal treatment, and disposal) would provide the highest degree of long-term effectiveness and permanence because the waste would be removed from the site. Alternatives 3b1, and 3b2 (ISV at ARA-16 or TAN) would be somewhat less effective and permanent because direct exposure to radiation would still be a risk at the site. Alternative 3a would be less effective because the contamination would remain at WAG 5 and the long-term effectiveness of the soil cover is less than the vitrified waste form. Therefore, direct exposure to radiation could be a risk in the future

12.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

For the contaminated soil sites only Alternatives 5a and 5b would reduce the volume of radiologically contaminated soil requiring disposal and were rated highest among the alternatives for contaminated soil relative to this criterion. For both ARA-02 and ARA-16, for all considered alternatives, with the exception of Alternative 1 (no action), the waste would be treated to reduce toxicity, mobility, and volume. For ARA-02, when compared to Alternative 4, Alternative 3 will provide greater reduction in toxicity, mobility and volume. For ARA-16, Alternatives 4, 3a, 3b1, and 3b2 are considered equivalent relative to this criterion.

12.3.5 Short-Term Effectiveness

For the contaminated soil sites, ARA-02, and ARA-16, Alternative 1 (no action) would be the most effective in the short-term because no actions resulting in additional worker exposure would occur. No off-Site exposures would occur because none of the sites are located near inhabited areas and no public roads are in the vicinity. No additional environmental impacts would result from this alternative other than the conditions already existing. Contaminant migration from surface soils via wind and water erosion is of concern. As noted previously, the BRA identifies risks that would not be addressed by the no action alternative. Furthermore, an assumption incorporated into this evaluation was that sites are immediately accessible to the public. Therefore, the no action alternative would not satisfy RAOs.

Alternatives 3b and 4a for the contaminated soil sites are considered equally effective for short-term protection because both involve about the same degree of soil excavation and transport. Alternative 4b would be considered slightly less effective because of some increase in potential risk to the public in the event of an accident during transportation to an off-Site disposal facility. Alternatives 5a and 5b would be less effective than Alternatives 3b, 4a, and 4b in the short-term because additional worker exposure would result from the increased handling of radiologically contaminated soil during the

separation process. In the short term, Alternative 5b is the least effective of these options because of the potential risk to the public from off-Site transportation.

For ARA-02, in the short term, Alternative 4 is more effective than Alternative 3 because no potential receptors would be in direct contact with the seepage pit sludge. However, because the contamination levels in the sludge are low, the risk to workers in implementing Alternative 3 would be low.

For ARA-16, Alternatives 3b2 and 4 both involve transfer of the tank waste into another container, which would result in the highest risk for exposure. Therefore, these alternatives are considered to be the least effective for short-term protection among the options for the tank waste. Alternative 3a is considered the most effective for the tank waste because direct exposure to ARA-16 tank contents would be avoided.

12.3.6 Implementability

Each of the alternatives retained for detailed analysis is technically implementable. Alternative 1 (no action) would be the most implementable for the soil sites, ARA-02, and ARA-16, because it would require no change in existing site conditions.

For the contaminated soil sites, Alternatives 3b, 4a, and 4b are equally implementable. All use conventional excavation equipment and rely on construction techniques that are known to be effective. Alternatives 5a and 5b are considered less implementable because of the uncertainties in effectiveness of the segmented gate system in reducing the volume of radiologically contaminated soils at WAG 5 sites.

Alternatives 3 and 4 for the ARA-02 sanitary waste system are equally implementable. Both use conventional and readily available equipment and technologies that are known to be effective. The facilities for treatment of ARA-02 sludge under Alternative 3 presently exist at the INEEL. The jet grouting technique to be used in Alternative 4 was developed and tested at the INEEL, and the equipment and methods required to implement this alternative are available commercially.

Alternative 4 is considered the most implementable for the ARA-16 radionuclide tank after Alternative 1. The facilities for storage of ARA-16 waste presently exist, and the equipment and methods required to implement this alternative are available. Alternative 3a is considered less implementable because ISV of a buried mixed waste tank has not been demonstrated. Alternatives 3b1 and 3b2 are the least implementable because a decision to perform ISV on the V-tanks at TAN has not been finalized and because RCRA disposal waivers would be required to relocate the WAG 5 waste to WAG 1 for disposal.

12.3.7 Cost

The comparative ranking of the alternatives relative to present cost is presented in Table 12-18. The level of detail used to develop the cost estimates presented is considered appropriate for comparing alternatives. Separate cost line items are developed for the primary components of each remedial action alternative, such as monitoring, capping, excavation, disposal, and reporting requirements (e.g., the RD/RA scope of work and work plans, safety documentation, and progress reports).

The level of detail presented in the cost estimates is consistent with the level of detail provided in the descriptions of each alternative. Additional details in the cost estimates are not considered appropriate without supporting detailed designs for each alternative. The uncertainty associated with each cost estimate increases with the complexity of the alternative.

12.4 References

25 USC 32, *United States Code*, Title 25, "Indians," Chapter 32, "Native American Graves Protection and Repatriation Act."

36 CFR 800, *Code of Federal Regulations*, Title 36, "Parks, Forests, and Public Property," Part 800, "Protection of Historic and Cultural Properties."

40 CFR 61.90, *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 61.90, "National Emission Standards for Hazardous Air Pollutants."

40 CFR 61.91 and .92, *Code of Federal Regulations*, Title 40, "Protection of Environment," Parts 61.91 and .92, National Emission Standards for Emissions of Radionuclides Other Than Radon from DOE of Energy Facilities National Emission Standards for Hazardous Air Pollutants.

40 CFR 122.26, *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 122.26, "Discharges of Storm Water to Waters of the United States National Pollutants Discharge Elimination System—Stormwater."

40 CFR 261.2, *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 261, "Identification and Listing of Hazardous Waste," Subpart .2, "Definition of Solid Waste."

40 CFR 261.24, *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 261, "Identification and Listing of Hazardous Waste," Subpart .24, "Toxicity Characteristic."

40 CFR 262, *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 262, "Standards Applicable to Generators of Hazardous Waste," Subpart B, "The Manifest."

40 CFR 262.11, *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 262, "Standards Applicable to Generators of Hazardous Waste," Subpart .11, "Hazardous Waste Determination."

40 CFR 264, *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities."

40 CFR 264, *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Subpart I, "Use and Management of Containers."

40 CFR 264, *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Subpart X, "Miscellaneous Units."

40 CFR 264.310, *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Subpart .310, "Closure and Post-Closure Care."

40 CFR 268, *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 268, "Land Disposal Restriction."

40 CFR 300.430(e)(9)(iii), *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 300, "National Oil and Hazardous Substances Pollution Contingency Plan."

40 CFR 700 through 799, *Code of Federal Regulations*, Title 40, "Protection of Environment," Parts 700 through 799, Toxic Substance Control Act.

40 CFR 761, *Code of Federal Regulations*, Title 40, "Protection of Environment," Part 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions."

U.S. Department of Energy Order 430.1, "Life Cycle Asset of Project and Fixed Asset Management Group," January 1998.

U.S. Department of Energy Order 5400.5, "Radiation Protection of the Public and the Environment" February 8, 1990.

IDAPA 16.01.05.005 through .011, "Hazardous Waste Management," Idaho Administrative Procedures Act.

IDAPA 16.01.11.200, "Groundwater Quality Standards," Idaho Administrative Procedures Act.

IDAPA 16.01.01.210, "Preconstruction Compliance with Toxic Standards," Idaho Administrative Procedures Act.

IDAPA 16.01.01.581, "Prevention of Significant Deterioration," Idaho Administrative Procedures Act.

IDAPA 16.01.01.585, and .586, "Toxic Air Pollutants Rules for Control of Air Pollution in Idaho," Idaho Administrative Procedures Act..

IDAPA 16.01.01.650 and .651, "Fugitive Dust Rules for Control of Air Pollution in Idaho," Idaho Administrative Procedures Act.

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Parsons, September 1997, Remedial Action Report OU 5-05 Stationary Low-Power Reactor No. 1 and OU 6-01 Boiling Water Reactor Experiment-1 Burial Grounds Engineered Barriers, DOE/ID-10591, Parsons Infrastructure and Technologies Group, Inc., for Lockheed Martin Idaho Technologies Company and U.S. Department of Energy, Idaho Operations Office.